Academic Librarians and Research Data Services: Attitudes and Practices

Objectives: Academic librarians in the United States and Canada were surveyed to ascertain their capacity and readiness to offer a range of research data services and how their perceptions have changed since a 2011 survey of academic librarians. We address the following questions:

RQ1: Do academic librarians feel they have the knowledge, background, and skills to provide library-based research data services (RDS)?

RQ2: How do academic librarians rate the importance of RDS in the library?

RQ3: What are the factors that contribute to or inhibit engagement of librarians in RDS?

RQ4: Are there changes in the opinions of academic librarians on these issues since the 2011 study?

Methods: Library directors who participated in a separate study of RDS practices in ACRL libraries were asked to distribute the current survey to their librarians. 168 librarians participated in this online survey yielding 146 valid responses for analysis in SPSS.

Results: Academic librarians for whom RDS is an integral part of their job feel confident in the ability to provide such services. The group of librarians for whom RDS is occasional or not a part of their responsibilities are less confident, but also agree that RDS is important in academic libraries. Consultative-time RDS, which are consistent with traditional library reference services, are much more likely to be part of librarians' job responsibilities.

Conclusion: Many academic librarians believe that RDS are important services in academic libraries. Not all are confident in their abilities to offer all specific services, however, so there is a need for collaborative training in RDS, particularly for those librarians where RDS responsibilities are not a full-time part of their job responsibilities.

Key Words: Academic librarians; academic libraries; library-based research data services; survey of librarians

Introduction

Becoming a partner in the research process and enabling access to the scholarship of e-science is a natural evolution of the traditional roles of academic libraries. Managing research data can be an important aspect of this expanded role, although many academic librarians may not feel they have the necessary preparation, skills, and capacity to effectively provide research data services. In addition, researchers need to understand the degree to which these services are becoming part of the core services offered by academic librarians in a variety of settings. Knowledge of the possibilities and confidence in their respective roles with research data are necessary for both the librarians who are called on to provide these services and the researchers who will take advantage of the services provided by librarians.

Research data services (RDS) are services "that address the full data lifecycle, including the data management plan, digital curation (selection, preservation, maintenance, and archiving), and metadata creation and conversion" (Tenopir et al. 2013). In the academic library, research data is being recognized as a new kind of cultural artifact that requires long-term stewardship, so librarians must extend their abilities to provide reference and instruction services and to curate and make discoverable data produced by researchers. This study examines how academic librarians in the United States and Canada perceive their capacity and readiness to offer a range of research data services and how these perceptions have changed since a 2011 survey of librarians in US and Canadian academic research libraries (Tenopir et al. 2013). This study addresses the following research questions:

RQ1: Do academic librarians feel they have the knowledge, background, and skills to provide library-based RDS?

RQ2: How do academic librarians rate the importance of RDS in the library?

RQ3: What are the factors that contribute to or inhibit engagement of librarians in RDS?

RQ4: Are there changes in the opinions of academic librarians on these issues since the 2011 study?

Related Research

The literature on the roles of librarians and libraries regarding a range of RDS is growing. Most studies focus on either *libraries* or *librarians* as their unit of analysis, and a few studies address both libraries and librarians. This study and this literature review focuses on librarians, their current activities and perceptions, and the remaining barriers that inhibit them from providing RDS.

There is much more literature on the role of libraries in regards to providing a full range of RDS, including articles that survey what libraries are currently doing in a variety of disciplinary settings and in different world regions.

Several studies use survey methods (Kennan, Corrall, and Afzal, 2014); (Tenopir et al., 2015); (Cox and Pinfield, 2014); (Reeve and Weller, 2015); (Cox et al., 2017); website content analysis (Si et al., 2015); (Nicholson and Bennett, 2017); (H. H. Yu, 2017), or case study (Witt, 2008); (Kong, Fosmire, and Branch, 2017) to learn what college, academic, and research libraries are currently providing in RDS. Studies focused on specific disciplinary areas or in the context of special libraries or focused clientele have also been conducted for veterinary medicine (Kerby, 2016), law (Reeve and Weller, 2015), and geographic information systems in a humanities and social sciences context (Kong, Fosmire, and Branch, 2017).

A smaller number of studies focus on the RDS that librarians are currently providing and their attitudes about their preparation for RDS and the availability of RDS training. A survey of librarian attitudes conducted in 2011 (Tenopir et al., 2013) focused on librarians in academic libraries that are members of the Association of Research Libraries. The study found almost three-quarters of participants did not have RDS established as part of their job responsibilities at the time. Librarians who provided RDS as an integral or occasional part of their responsibilities were more likely to feel that they had the knowledge and skills to provide RDS to their faculty and students. Whether they currently offered RDS as part of their job or not, academic librarians felt they are or would be motivated to do so if RDS became a job responsibility or their patrons asked for RDS.

An international survey of academic librarians in Australia, Ireland, New Zealand, and the United Kingdom examined professional and education implications for academic libraries with respect to RDM including how these libraries "make space" for new services (Kennan, Corrall, and Afzal, 2014). This study found that academic libraries are "…constrained by gaps in staff skills, knowledge, and confidence and resourcing issues" (p. 666). Cox and Pinfield surveyed UK higher education and research institutions in 2012 to gauge the extent to which research data management was a strategic priority for these libraries (Cox and Pinfield, 2014). They found that "…libraries were offering limited research data management services, with highest levels of activity in large research-intensive institutions" and found "major challenges associated with skills gaps, resourcing and cultural change." (p. 299).

Science librarians at ARL libraries were surveyed in 2012 to learn about their involvement with institutional and data repositories and a range of RDS services (Antell et al., 2014). Responses were interpreted as revealing either "uncertainty" or "optimism". Areas that revealed librarian uncertainty included who on their campuses is responsible for operating data repositories, performing various roles, or which skills are important for librarians. Areas where librarians expressed optimism included the ability to apply traditional reference skills such as "…liaise, refer, consult, and teach" (p. 571) and the potential for new lines of service.

Studies with more narrow foci include a survey of veterinary librarians about their experiences with and perceptions of RDS (Kerby, 2016) and interviews of experiences providing research data and other liaison services as embedded members of faculty research projects (Bedi and Walde, 2017).

Several studies of either libraries or librarians make recommendations as to what libraries and individuals should do to improve the state of RDS, including training, increasing or reallocating resources, focusing on communications and messaging, and modifying institutional or professional culture (Cox and Pinfield, 2014); (Cox and Verbaan 2016); (Koltay, 2016); (Conrad et al,. 2017); (Nicholson and Bennett, 2017); (F. Yu, Deuble, and Morgan, 2017).

The studies of libraries and librarians confirm that librarians have many of the skills required to provide RDS, including formal training in organizing information and assisting with information discovery. RDS work also requires additional training and an appreciation of the cultural differences between librarians and researchers. Studies recommend improving LIS curricula (Kennan, Corrall, and Afzal, 2014); (Cox et al., 2017), changing LIS training to prepare practitioners to address complex, "wicked" problems (Cox, Pinfield, and Smith, 2016), or providing institutional support for liaison librarians transitioning to a focused data librarian role or being embedded in research projects (Brown, Wolski, and Richardson, 2015).

In addition, there are a growing number of resources available to help librarians develop RDS. Surkis and Read (2015) provide a primer for librarians on types of RDS that might be offered. LIS and iSchools have developed degree programs (e.g., University of Illinois at Urbana-Champaign; Syracuse University; University of North Carolina – Chapel Hill) and standalone online courses, such as MANTRA (*https://mantra.edina.ac.uk/*), are available. Several professional organizations around the world are supporting RDS training for librarians. ACRL has developed a workshop to help liaison librarians integrate RDS into their work ("Building Your Research Data Management Toolkit: Integrating RDM into Your Liaison Work" 2016). DataONE provides a Librarian Outreach Kit (*https://www.dataone.org/for-librarians*). The LIBER "Research Data Management Working Group" evaluates and supports RDS skills development tools for academic librarians (*https://libereurope.eu/strategy/research-infrastructures/rdm/*). Librarians have also self-organized into groups, such as the Mendeley Data Management for Librarians group and the Research Data Access and Preservation *(RDAP –https://www.asist.org/rdap/*) group.

Methods

This study of attitudes of librarians in all types of academic institutions follows an earlier study of academic library RDS policies and services, sent to library directors who were members of a research panel put together by ACRL (Tenopir et al., 2015). Library directors who participated in the study of RDS practices in ACRL libraries (n=221) were asked

to distribute this attitudes survey to their librarians in 2014. After cleaning data, 146 responses of 168 initial responses remained for analysis. The survey instrument was built in Qualtrics software and housed on the servers at the University of Tennessee, Knoxville and approved by the University of Tennessee Institutional Review Board for Human Subjects. Responses were imported from Qualtrics and analyzed in SPSS; see Appendix for the survey instrument.

Limitations

The number of responses is small, compared to the number of librarians working in academic libraries in the U.S. and Canada. Distribution of the survey was left to directors who were part of an ACRL stratified panel who responded to the previously mentioned survey of library practices (Tenopir et al., 2015). We do not know how many directors chose to distribute this second survey to their librarians, nor do we know how many librarians received it, so we cannot calculate a response rate. Librarians with an interest in RDS are more likely to have responded to this survey, so responses likely show an inflated interest in RDS issues. We also expect that the respondents are more likely to come from larger academic research libraries, rather than from smaller community colleges or four-year colleges. There may be different number of responses for each question and the final questions typically have the lowest number of responses because, due to IRB requirements, respondents were allowed to skip any question or drop out before the survey was complete. The sample size (n=) for each question may therefore differ. Demographic questions were at the end of the survey, so these questions frequently have lower numbers of responses. This effects the number of responses within cross-tabulations that use a demographic for the independent variable.

Results

While respondents came from a wide range of service areas, the majority who answered the question (53.8 %) are *reference & instruction/service liaison, or subject specialist*. The second most frequent area is *library management* (18.7 %), such as head librarian, dean, etc. The most common choice for *primary disciplinary focus of service*, is "service not focused on a subject specialty" (27.2 %), with social sciences being the next most common response (18.5 %). (Table 1 and Table 2).

n=91	**Frequency (Percent)**
Reference & instruction/subject liaison or subject specialist	49 (53.8%)
Library management (head librarian/dean, AUL	17 (18.7%)
Special collections/archives	4 (4.4%)
Cataloging/bibliographic control	4 (4.4%)
Government Documents	3 (3.3%)
Circulation or access services (circulation, interlibrary loan)	2 (2.2%)
Collections management and development	2 (2.2%)
Metadata	2 (2.2%)
Research data services/data curation	2 (2.2%)
Library administration (human resources, budget, finance, marketing. etc.)	2 (2.2%)
Digitization/digital services/digital preservation	1 (1.1%)
Informational technology (Web, systems administration, programming)	1 (1.1%)
Electronic resources/serials/licensing	1 (1.1%)
Other	1 (1.1%)
Preservation/conservation of physical items	-
Assessment	-
Acquisitions	-
Scholarly communications/repository management	-
Maps	-

Table 1. Primary Library Service Area of Respondents

n=92	Frequency (Percent)
My service does not focus on a particular subject specialty	25 (27.2%)
Social sciences	17 (18.5%)
Other	11 (12%)
Business	7 (7.6%)
Humanities	6 (6.5%)
Engineering	5 (5.4%)
Physical sciences (chemistry, physics, etc.)	5 (5.4%)
Biological sciences	4 (4.3%)
Arts, music, theater, architecture	4 (4.3%)
Human health sciences/medical sciences	3 (3.3%)
Agriculture	1 (1.1%)
Education	1 (1.1%)
Veterinary sciences	1 (1.1%)
Law	1 (1.1%)
Earth and environmental sciences (geology, ecology, etc.)	1 (1.1%)

Table 2. Primary Disciplinary Focus of Respondents

Just 52 of the librarians reported that they work in a library that has an institutional repository. Of these 52, three-quarters report that their repository supports the deposit of data (n=39, 75 %).

Even though some of the respondents work in libraries that support data deposit, opinions likely differ based on the level of involvement with RDS. We expect that librarians who perform RDS tasks as an integral part of their job responsibilities will differ in their opinions from those who perform these tasks only occasionally or not at all. Therefore, we asked respondents: *do you interact with faculty, students, or staff in support of their research data services (RDS) as part of your regular job responsibilities*. Of the 146 who answered this question, almost two-thirds (65 %) indicated "yes" they perform RDS at least occasionally (Figure 1). This question on RDS interaction type was used for cross-tabulation with other questions that pertained to sentiments regarding RDS.

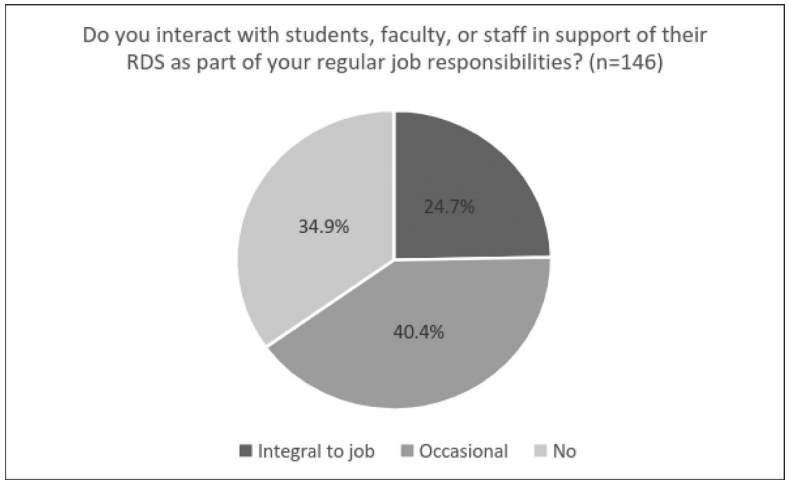


Figure 1. Librarian Responsibilities Regarding RDS

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There is a direct relationship between level of responsibility for RDS and agreement with the statement that "*My patrons need RDS".* While 80 % of those for whom RDS is integral to their job agree or strongly agree that their patrons need RDS, just over half (57.7 %) of the occasional respondents and about a third (37.1 %) of those who have no RDS responsibilities agree (Table 3.) It is not surprising that librarians who are more involved with RDS see their patrons' needs differently.

When asked to agree or disagree with the statement "*My library has adequate funding for RDS"*, participant responses also varied by responsibilities. Only about a quarter each of those with occasional or no responsibility for RDS in their jobs feel their library has adequate funding for RDS, while 40 % of the respondents for whom RDS is integral to their jobs believe their library has adequate funding (Table 3). Perhaps this is because libraries without adequate funding do not have dedicated RDS librarians.

	Interaction	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
My patrons need RDS	Integral	9 (45%)	7 (35%)	4 (20%)	-	-
	Occasional	15 (33.3%)	11 (24.4%)	12 (26.7%)	4 (8.9%)	3 (6.7%)
	No	4 (11.4%)	9 (25.7%)	10 (28.6%)	8 (22.9%)	4 (11.4%)
My library has adequate funding for RDS	Integral	3 (15%)	5 (25%)	6 (30%)	4 (20%)	2 (10%)
	Occasional	4 (8.9%)	8 (17.8%)	12 (26.7%)	10 (22.2%)	11 (24.4%)
	No	4 (11.4%)	5 (14.3%)	9 (25.7%)	9 (25.7%)	8 (22.9%)

Table 3. Context of RDS

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Librarians who have RDS as an integral part of their job agree that they have "*the skills, knowledge, and resources available to provide or develop RDS"* (82 %), compared to less than half (46.6 %) of the occasional group and less than a quarter (17.2 %) of the no group (Table 4). Although a majority of all respondents agree that they have "*sufficient subject expertise to help their patrons*" there is variation between the three respondent groups, with the integral group being quite confident (95.5 % strongly agree or agree.)

Lack of time may be a major barrier to offering RDS. For those who do not have RDS responsibilities, only a few (11.4 %) agree and only about a third of the occasional group (37.8 %) agree with the statement "*My job allows me sufficient time to provide RDS to patrons*." Over three-quarters (77.3 %) of the integral group agree they have sufficient time (Table 4). Lack of time, skills, and knowledge to offer RDS can be addressed by opportunities for professional development. Significantly more of the integral group feel they have access to RDS training (77.3 %) than do the occasional group (35.5 %) or those with no RDS responsibilities (20 %) (Table 4). Library-provided opportunities to develop RDS skills vary. Those who have integral or occasional RDS responsibilities are more likely to feel they have access to such opportunities (Table 4).

	Interaction	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
I have the necessary skills, knowledge, etc. to provide RDS	Integral	8 (36.4%)	10 (45.5%)	3 (13.6%)	-	1 (4.5%)
	Occasional	1 (2.2%)	20 (44.4%)	4 (8.9%)	14 (31.1%)	6 (13.3%)
	No	1 (2.9%)	5 (14.3%)	3 (8.6%)	7 (20%)	19 (54.3%)
I have sufficient subject expertise to help my patrons	Integral	13 (59.1%)	8 (36.4%)	1 (4.5%)	-	-
	Occasional	8 (17.8%)	28 (62.2%)	2 (4.4%)	5 (11.1%)	2 (4.4%)
	No	8 (22.9%)	14 (40%)	3 (8.6%)	8 (22.9%)	2 (5.7%)
My job allows me sufficient time to provide RDS to patrons	Integral	7 (31.8%)	10 (45.5%)	4 (18.2%)	1 (4.5%)	0 (0%)
	Occasional	4 (8.9%)	13 (28.9%)	6 (13.3%)	10 (22.2%)	12 (26.7%)
	No	2 (5.7%)	2 (5.7%)	13 (37.1%)	3 (8.6%)	15 (42.9%)
I have access to training in RDS to meet patrons' needs	Integral	9 (40.9%)	8 (36.4%)	3 (13.6%)	2 (9.1%)	0 (0%)
	Occasional	5 (11.1%)	11 (24.4%)	9 (20%)	15 (33.3%)	5 (11.1%)
	No	3 (8.6%)	4 (11.4%)	9 (25.7%)	12 (34.3%)	7 (20%)
My library provides opportunities to develop skills related to RDS	Integral	7 (31.8%)	8 (36.4%)	4 (18.2%)	2 (9.1%)	1 (4.5%)
	Occasional	8 (17.8%)	16 (35.6%)	7 (15.6%)	10 (22.2%)	4 (8.9%)
	No	4 (11.4%)	9 (25.7%)	10 (28.6%)	6 (17.1%)	6 (17.1%)

Table 4. Self-Assessment of Skills for RDS

Professional development can be offered in many ways. Three-quarters of the integral group feel their *library supports taking courses specific to RDS*, while just over half (55.5 %) of the occasional group and 44.1 % of the no RDS group feel they have the same support (Table 5). Almost half or more in each group feel they have *support to attend conferences or workshops*.

	Interaction	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewh at Disagree	Strongly Disagree
My library supports me to take courses related to RDS	Integral	7 (35%)	8 (40%)	2 (10%)	3 (15%)	-
	Occasional	10 (22.2%)	15 (33.3%)	11 (24.4%)	3 (6.7%)	6 (13.3%)
	No	6 (17.6%)	9 (26.5%)	14 (41.2%)	5 (14.7%)	-
My library supports me to attend conferences/ workshops	Integral	10 (50%)	6 (30%)	2 (10%)	2 (10%)	-
	Occasional	11 (24.4%)	17 (37.8%)	10 (22.2%)	4 (8.9%)	3 (6.7%)
	No	7 (20%)	9 (25.7%)	13 (37.1%)	5 (14.3%)	1 (2.9%)

Table 5. Professional Development for RDS

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Perceptions about RDS within the library seem to follow a similar pattern to the self-assessment and skills development results. Two-thirds of the integral group agreed (66.6 %) with the statement *My patrons request RDS*, while just over one-third (36.3 %) of the occasional group and just a few of the no RDS group (8.8 %) agreed (Table 6). These responses may be either an indication of current library priorities or a reflection of institutions ability to support a dedicated RDS librarian. Two-thirds (66.7 %) of the integral group believe that *"RDS is a priority at my library"*, while just over one-third (38.6 %) of the occasional group and 14.7 % of the no RDS group agree.

Librarians' personal opinions on the importance of RDS may diverge from their library's priorities, however. Almost all (94.4 %) of the integral group strongly agree or agree with the statement *"RDS are just as important as other activities".* Two-thirds of the occasional group (65.9 %) also agree (Table 6). Despite agreement on the importance of RDS, fewer librarians agreed with the statement *"My library has sufficient technical infrastructure to support RDS.".* Just over half (55.6 %) of integral group agreed with this statement, as did less than one-third of the occasional group (30.3 %) and just over a quarter of librarians who do not provide RDS (27.3 %).

	Interaction	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
My patrons request RDS	Integral	6 (33.3%)	6 (33.3%)	5 (27.8%)	-	1 (5.6%)
	Occasional	2 (4.5%)	14 (31.8%)	11 (25%)	13 (29.5%)	4 (9.1%)
	No	-	3 (8.8%)	7 (20.6%)	14 (41.2%)	10 (29.4%)
RDS are a priority at my library	Integral	7 (38.9%)	5 (27.8%)	3 (16.7%)	2 (11.1%)	1 (5.6%)
	Occasional	6 (13.6%)	11 (25%)	12 (27.3%)	9 (20.5%)	6 (13.6%)
	No	2 (5.9%)	3 (8.8%)	9 (26.5%)	4 (11.8%)	16 (47.1%)
RDS are just as important as other activities	Integral	11 (61.1%)	6 (33.3%)	1 (5.6%)	-	-
	Occasional	11 (25%)	18 (40.9%)	7 (15.9%)	3 (6.8%)	5 (11.4%)
	No	1 (2.9%)	5 (14.7%)	10 (29.4%)	9 (26.5%)	9 (26.5%)
My library has sufficient tech. infrastructure	Integral	4 (22.2%)	6 (33.3%)	5 (27.8%)	2 (11.1%)	1 (5.6%)
	Occasional	6 (14%)	7 (16.3%)	11 (25.6%)	12 (27.9%)	7 (16.3%)
	No	3 (9.1%)	6 (18.2%)	6 (18.2%)	10 (30.3%)	8 (24.2%)

Table 6. Perceptions of the Importance of RDS in the Library

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We also asked a series of questions about librarians' attitudes towards the larger issues of e-science. The majority of respondents across all groups agree with the statement *"Losing data/data sets jeopardizes future scholarship"* (Table 7). Similarly, 100 % of the members of the integral group and a large majority of respondents in occasional group (90.6 %) and no group (84.8 %) agree that "*Librarians should be stewards of all types of scholarship, including data sets*." Despite this agreement on the importance of preserving data sets and the relevance of data stewardship to the library's mission, only three-quarters of the integral group (75.1 %), about two-thirds of the occasional group (61.4 %), and less than half of the no group (45.5 %) reported that *"Researchers will be at a disadvantage if the library does not offer RDS."* This may indicate that organizations other than the library are currently offering or are expected to offer these services.

	Interaction	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
Losing data jeopardizes future scholarship	Integral	8 (50%)	7 (43.8%)	1 (6.3%)	-	-
	Occasional	25 (58.1%)	10 (23.3%)	5 (11.6%)	-	3 (7%)
	No	18 (54.5%)	9 (27.3%)	4 (12.1%)	-	2 (6.1%)
Librarians should be stewards of all scholarship	Integral	12 (75%)	4 (25%)	0 (0%)	-	-
	Occasional	23 (52.3%)	17 (38.6%)	3 (6.8%)	1 (2.3%)	0 (0%)
	No	17 (51.5%)	11 (33.3%)	5 (15.2%)	-	-
Researchers will be at a disadvantage if library does not offer RDS	Integral	7 (43.8%)	5 (31.3%)	4 (25%)	-	-
	Occasional	9 (20.5%)	18 (40.9%)	11 (25%)	3 (6.8%)	3 (6.8%)
	No	6 (18.2%)	9 (27.3%)	11 (33.3%)	5 (15.2%)	2 (6.1%)

Table 7. Perceptions of the Importance of Data and RDS

A majority of librarians in all groups also agree that "*The library needs to offer RDS to remain relevant to the institution"* (Table 8). There is more disagreement on whether or not lack of RDS will result in a decrease in library funding. Nearly two-thirds of the integral group (62.6 %) agree that their library *"will see decreased funding if it does not offer RDS",* whereas under one-third of the occasional group (29.2 %) and only 15.2 % of the no group agree. This may reflect the differing missions of the institutions in which the respondents work. A notable percentage of respondents in each group, including almost half of the no group (48.5 %) neither agreed nor disagreed with this statement, an indication that the impact of RDS on future library funding may not yet be clear.

	Interaction	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
The library needs to offer RDS to remain relevant	Integral	10 (62.5%)	5 (31.3%)	1 (6.3%)	-	-
	Occasional	19 (43.2%)	13 (29.5%)	8 (18.2%)	2 (4.5%)	2 (4.5%)
	No	7 (21.2%)	13 (39.4%)	10 (30.3%)	-	3 (9.1%)
Library will see decreased funding if it does not offer RDS	Integral	3 (18.8%)	7 (43.8%)	5 (31.3%)	1 (6.3%)	-
	Occasional	5 (11.4%)	8 (18.2%)	17 (38.6%)	10 (22.7%)	4 (9.1%)
	No	2 (6.1%)	3 (9.1%)	16 (48.5%)	5 (15.2%)	7 (21.2%)

Table 8. Impact of RDS

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Librarians are in general agreement that offering RDS "*increases the visibility or impact of the library"* (Table 9.) Similarly, all groups overwhelmingly disagree with the statement that it is *not necessary for librarians to provide RDS* and with the statement that *RDS are a distraction from library's mission*.

There is some divergence among groups, however, about whether the library is *the best-suited entity to provide RDS*. Almost all members of the integral group (87.5 %) believe the library is the place for RDS, while just two-thirds of the occasional group (65.9 %) and under half of the no RDS group (48.5 %) agree (Table 9). This may again reflect differing institutional missions, differences in library resources, or perhaps the existence of other organizations better equipped to provide RDS to researchers.

	Interaction	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
Providing RDS will increase visibility/impact	Integral	10 (62.5%)	4 (25%)	2 (12.5%)	-	-
	Occasional	19 (43.2%)	15 (34.1%)	9 (20.5%)	1 (2.3%)	-
	No	10 (30.3%)	17 (51.5%)	5 (15.2%)	-	1 (3%)
Not necessary for librarians to provide RDS	Integral	-	-	2 (12.5%)	7 (43.8%)	7 (43.8%)
	Occasional	2 (4.5%)	2 (4.5%)	8 (18.2%)	20 (45.5%)	12 (27.3%)
	No	-	3 (9.1%)	9 (27.3%)	16 (48.5%)	5 (15.2%)
RDS are a distraction from library's mission	Integral	-	-	2 (12.5%)	5 (31.3%)	9 (56.3%)
	Occasional	1 (2.3%)	3 (6.8%)	7 (15.9%)	14 (31.8%)	19 (43.2%)
	No	-	3 (9.1%)	8 (24.2%)	13 (39.4%)	9 (27.3%)
Library is best-suited entity to provide RDS	Integral	9 (56.3%)	5 (31.3%)	2 (12.5%)	-	-
	Occasional	10 (22.7%)	19 (43.2%)	12 (27.3%)	1 (2.3%)	2 (4.5%)
	No	6 (18.2%)	10 (30.3%)	10 (30.3%)	6 (18.2%)	1 (3%)

Table 9. Sentiments About Library Involvement with RDS

In relation to the library's role as a provider of RDS, three-quarters to nearly two-thirds of each group agree that "*providing RDS increases a library's prestige"* (Table 10). There is also general agreement (but to a lesser degree) with the statement "*decentralized, departmental or college RDS will result in suboptimal stewardship*."

Librarians are less clear on the potential impact of failure to support RDS on students and institutional accreditation. Neither agree nor disagree was the most common response for all but the integral group to the statement "*Without RDS by the library, graduates will be data illiterate";* among the integral group, half agreed with this statement. Neither agree nor disagree was also the most common response for all but the integral group to the statement "*Failure to support RDS through the library will negatively impact institutional accreditation";* slight over half of the integral group (56.3 %) agreed with this statement as well (Table 10).

	Interaction	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
Providing RDS increases a library's prestige	Integral	6 (37.5%)	6 (37.5%)	4 (25%)	-	-
	Occasional	12 (27.3%)	20 (45.5%)	12 (27.3%)	-	-
	No	4 (12.1%)	17 (51.5%)	11 (33.3%)	1 (3%)	-
Decentralized RDS will result in suboptimal stewardship	Integral	1 (6.3%)	10 (62.5%)	4 (25%)	1 (6.3%)	-
	Occasional	9 (20.5%)	12 (36.4%)	16 (36.4%)	6 (13.6%)	1 (2.3%)
	No	4 (12.1%)	12 (36.4%)	13 (39.4%)	3 (9.1%)	1 (3%)
Without RDS by a library, grads will be data illiterate	Integral	3 (18.8%)	5 (31.3%)	5 (31.3%)	3 (18.8%)	-
	Occasional	6 (14%)	9 (20.9%)	14 (32.6%)	12 (27.9%)	2 (4.7%)
	No	-	7 (21.2%)	14 (42.4%)	9 (27.3%)	3 (9.1%)
Failure to support RDS through lib. will negatively	Integral	3 (18.8%)	6 (37.5%)	5 (31.3%)	1 (6.3%)	1 (6.3%)
	Occasional	3 (6.8%)	11 (25%)	19 (43.2%)	7 (15.9%)	4 (9.1%)
	No	-	6 (18.2%)	15 (45.5%)	9 (27.3%)	3 (9.1%)
impact accreditation						

Table 10. Sentiments about the Impact of RDS on Students

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We asked not only about respondents' general beliefs regarding RDS, but also about the specific types of RDS they performed in the course of their work, as well as how often they performed each type of service. This data was gathered to identify current practices, to reveal any disconnect that may exist between librarians' beliefs and actual practices, and to potentially highlight organizational barriers to adopting RDS. In previous studies of libraries, researchers identified two categories of RDS provided by libraries: consultative/informational RDS and technical

or hands-on RDS (Tenopir et al., 2013; Tenopir et al., 2015; Tenopir et al., 2017). Consultative or information RDS are those services that tend to align with the traditional reference or instructional services provided by librarians, including helping faculty, staff or students locate data sets, providing web guides or finding aids for data, and providing help with data management plans. Technical or hands-on RDS are those services performed on data or data sets, such as preparation of data sets for repositories, creation of metadata, and providing technical support for RDS systems, that may require more specialized technical expertise or experience in dealing with research data sets. In previous studies of RDS in both North America and Europe, we found that consultative RDS were offered by more libraries than were technical RDS (Tenopir et al., 2014; Tenopir et al., 2015; Tenopir et al., 2017).

Librarians were asked about the frequency with which they performed a variety of consultative RDS with faculty and staff and with students. A majority of librarians in the integral group performed all identified consultative RDS with faculty and staff at least occasionally, and all services except consultation on metadata standards with students at least occasionally. Consultation on locating available data or datasets and instruction on finding, citing, or appropriately using data – both extensions of the traditional reference and instruction roles – were the services offered by the most librarians. As expected, those in the occasional group performed consultative RDS less frequently, but a majority did provide consultation on locating available data or datasets, creating web guides and finding aids for data /data sets/ data repositories and instruction on finding, citing, or appropriately using data with both faculty and staff at least occasionally (Table 11).

Perform RDS	Interaction	Never	Occasionally	Frequently
Consultation on locating available data/sets	Integral	1 (3.2%)	14 (45.1%)	16 (51.6%)
	Occasional	9 (17%)	39 (73.6%)	5 (9.4%)
	No	27 (64.3%)	15 (35.7%)	-
Consultation on metadata standards	Integral	10 (35.7%)	16 (57.1%)	2 (7.1%)
	Occasional	34 (65.4%)	18 (34.6%)	-
	No	34 (81%)	7 (16.7%)	1 (2.4%)
Consultation on data management plans	Integral	7 (24.1%)	18 (62%)	4 (13.8%)
	Occasional	31 (59.6%)	21 (40.4%)	-
	No	39 (92.9%)	3 (7.2%)	-
Creating web guides and finding aids	Integral	2 (6.9%)	16 (25.1%)	11 (37.9%)
	Occasional	15 (28.3%)	35 (66%)	3 (5.7%)
	No	32 (76.2%)	10 (23.8%)	-
Direct participation with researchers in a project	Integral	8 (26.7%)	14 (46.6%)	8 (26.7%)
	Occasional	32 (65.3%)	15 (30.6%)	2 (4%)
	No	36 (87.8%)	4 (9.8%)	1 (2.4%)
Instruction on finding/citing/ using data	Integral	-	15 (50%)	15 (50%)
	Occasional	15 (30.6%)	30 (61.2%)	4 (8.2%)
	No	21 (51.2%)	19 (46.3%)	1 (2.4%)
Identifying data sets	Integral	6 (20.7%)	22 (75.9%)	1 (3.4%)
	Occasional	29 (59.2%)	18 (36.7%)	2 (4.1%)
	No	36 (87.8%)	5 (12.2%)	-

Table 11. How frequently do you perform the following RDS with faculty or staff? (Consultative Services)

Consultative services are also often frequently offered to students. Even some of those who reported they did not perform RDS as part of their regular job responsibilities did provide some types of consultative RDS at least occasionally, with at least half providing consultation on locating available data or datasets to students (Table 12).

Perform RDS	Interaction	Never	Occasionally	Frequently
Consultation on locating available data/sets	Integral	2 (6.5%)	16 (51.6%)	13 (41.9%)
	Occasional	11 (22%)	33 (66%)	6 (12%)
	No	22 (53.7%)	18 (43.9%)	1 (2.4%)
Consultation on metadata standards	Integral	17 (58.6%)	11 (37.9%)	1 (3.4%)
	Occasional	40 (80%)	10 (20%)	-
	No	39 (95.1%)	2 (4.9%)	-
Consultation on data management plans	Integral	14 (46.7%)	14 (46.7%)	2 (6.6%)
	Occasional	37 (74%)	13 (26%)	-
	No	40 (100%)	-	-
Creating web guides	Integral	10 (33.3%)	13 (43.4%)	7 (23.3%)
	Occasional	19 (38%)	30 (60%)	1 (2%)
	No	30 (73.2%)	11 (26.8%)	-
Direct participation in project using data	Integral	14 (48.3%)	11 (37.9%)	4 (13.7%)
	Occasional	37 (77.1%)	11 (22.9%)	-
	No	39 (97.5%)	1 (2.5%)	-
Instruction on finding/citing/ using data	Integral	2 (6.7%)	15 (50%)	13 (43.3%)
	Occasional	9 (18.8%)	36 (75%)	3 (6.3%)
	No	20 (50%)	19 (47.5%)	1 (2.5%)
Identifying data sets	Integral	11 (36.7%)	16 (53.3%)	3 (10%)
	Occasional	34 (70.8%)	13 (27.1%)	1 (2.1%)
	No	33 (84.6%)	6 (15.4%)	-

Table 12. How frequently do you perform the following RDS with students? (Consultative Services.)

As was expected based on past studies, fewer librarians reported they performed technical RDS. No technical RDS were offered by a majority of any group, with the exception of metadata creation and selection of data and data sets for deposit. Both of these services were offered at least occasionally by a majority of the integral group (Table 13).

Tech. support for RDS systems	Occasional	38 (79.2%)	9 (18.7%)	1 (2.1%)
	No	36 (94.7%)	2 (5.3%)	-
Deaccession of data/sets	Integral	14 (58.3%)	9 (37.5%)	1 (4.2%)
	Occasional	42 (89.4%)	4 (8.6%)	1 (2.1%)
	No	37 (97.4%)	1 (2.6%)	-
	Integral	14 (58.3%)	9 (37.5%)	1 (4.2%)
Format migration of data files	Occasional	42 (87.5%)	5 (10.4%)	1 (2.1%)
	No	38 (100%)	-	-
Replication/backup of data/data sets	Integral	13 (52%)	9 (36%)	3 (12%)
	Occasional	41 (85.4%)	6 (12.5%)	1 (2.1%)
	No	38 (100%)	-	-
Authentication of data/sets	Integral	16 (66.7%)	8 (33.4%)	-
	Occasional	41 (85.4%)	6 (12.5%)	1 (2.1%)
	No	38 (100%)	-	-

Table 13. How frequently do you perform the following research data services (RDS) on data/data sets or systems?